

25 June 2004

To: Paul Philp
DOE Project Manager, Run IIb CDF Detector Project

From: Pat Lukens
Project Manager for the Run IIb CDF Detector Project

Subject: Run IIb CDF Detector Project May 2004 Report

Attached is the monthly report summarizing the May 2004 activities and progress for the Fermilab RunIIb CDF Detector Project. This report is available electronically at:

<http://www-cdf.fnal.gov/run2b.html>

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RunIIb CDF Detector Project
Progress Report No. 18
1 - 31 May 2004

I. PROJECT DESCRIPTION

The primary goal of the CDF Run IIb Detector Project is to enable the detector to exploit the physics opportunities available during Tevatron operation through 2008. The data from Run II will represent a set of detailed measurements that can be compared with the predictions of the Standard Model at the highest available collision energy. The increased size of the data sample will allow us to study the top quark by measuring the details of its production and decay mechanism. In addition, we plan precision electroweak and QCD measurements, continued searches for a variety of phenomena that are predicted to exist beyond the Standard Model framework, and to explore CP violation in the b quark sector. The detailed physics goals of the upgrade are described in the Technical Design Report (TDR).

The major tasks of this upgrade are:

- Upgrade the calorimeter by replacing the Central Preradiator Chamber with a device with shorter response time to allow operation in a high-luminosity environment, and adding timing information to the electromagnetic calorimeters.
- Upgrade the data acquisition and trigger systems to increase throughput needed for higher luminosity operation and efficiently trigger on the higher multiplicity events of Run IIb.

II. OVERVIEW OF PROJECT STATUS – P. Lukens

A Director's review of the project is scheduled for 20-21 July 2004. The charge and agenda are being developed, but we anticipate discussion of the installation needs of the project and how they will impact the operations schedule during the fall 2004 shutdown. In addition, we are using this review as an internal deadline for any schedule or scope corrections needed for the project.

A Production Readiness Review of the TDC and project was held on 21 May 2004. A review committee formed of CDF members with data acquisition and TDC experience commented on the progress, and supported of the project and procurement plan. Several additional tests were called out as needed before the final production order. In particular, a larger scale test is needed, where a full VME crate of TDCs is tested within the CDF data acquisition system. We have begun preparation of the contracts and bid packages for this quantity of TDCs (probably 25-35 units). The schedule for the TDC project is being refined to reflect today's understanding of the testing needs.

In internal review of the track trigger upgrade (XFT) was held on 25 May 2004. The XFT proponents presented the current state of understanding of the high luminosity projection for the existing system and the upgraded system. This understanding has matured significantly since the baseline review of September 2002. The proponents are developing a new schedule for the track trigger, which will be final by the time of the Director's review.

III. PROJECT MILESTONE SUMMARY (as of 31 May 2004)

CDF Level 2 Schedule Milestones from the Resource Loaded schedules

WBS	Title	Baseline Comp. Date	Forecast/Actual Completion Date	Complete
1.2.1.10.1	First phototube order placed	9-May-03	1-Apr-03	Yes
1.2.2.2.7.1	Prototype Testing Complete	16-May-03	28-Mar-03	Yes
1.2.2.2.7.4	ASD->TDC Cables ready for installation	16-May-03	26-Aug-03	Yes
1.2.2.2.7.2	CEM Splitters ready for installation	19-May-03	29-Jul-03	Yes
1.2.2.2.7.3	PEM Harnesses ready for installation	2-Sep-03	28-Apr-03	Yes
1.2.2.2.7.5	All cables done and ready to install	2-Sep-03	26-Aug-03	Yes
1.2.2.2.7.8	VME Crate ready for installation	7-Oct-03	30-Apr-03	Yes
1.3.2.6.3	Begin production of Level 2 Pulsar system	12 Nov 03	12 Nov 03	Yes
1.3.1.6.6	First Prototype TDC available for testing	19-Nov-03	16-Feb-04	Yes
1.2.2.2.7.10	Upstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.11	All EM Timing components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.6	ASD/TB ready for installation	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.7	Downstairs components ready to install	7-Jan-04	16-Oct-03	Yes
1.2.2.2.7.9	TDC boards ready for installation	7-Jan-04	16-Oct-03	Yes
1.3.3.2.3.4	Begin fabrication of Prototype Finder 1/3 board	8-Jan-04	8-Jan-04	CR in process
1.2.1.10.3	First set of Calorimeter phototubes tested	30-Jan-04	20-Oct-03	Yes
1.3.3.8.1.9	Prototype XFT Linker Module available for testing	26-Mar-04	26-Mar-04	CR in process
1.2.1.10.2	1 st Calorimeter WLS fiber holder finished	1-Apr-04	17-Feb-04	Yes
1.3.4.4.1.4	Prototype Event Builder hardware arrives	3-Jun-04	31 Mar 04	Yes
1.2.1.10.4	1 st CPR module finished and tested	4-Jun-04	15-Mar-04	Yes
1.2.1.10.6	1 st CCR module finished and tested	19-Jul-04	2-Mar-04	Yes
1.3.2.9	Pulsar Level 2 subproject ready for installation	4-Aug-04	4-Aug-04	
1.2.1.10.5	2 nd set of Calorimeter phototubes tested	6-Aug-04	26-Mar-04	Yes
1.3.5.2.5	Arrival of 0/10 PCs from the vendor	10-Sep-04	10-Sep-04	
1.3.4.5.3	Production Readiness Rev - Event Builder	4-Oct-04	4-Oct-04	
1.3.3.10.3.3	Preproduction XFT Stereo Assoc Modules	29-Nov-04	29-Nov-04	
1.3.6.5	SVT ready for installation	13-Dec-04	13-Dec-04	
1.3.1.12	Beginning of TDC Production	10-Jan-05	10-Jan-05	
1.2.1.10.7	50% Calorimeter CPR Detectors Tested	14-Jan-05	30 Nov 04	
1.3.4.5.4.4	Arrival of Event Builder hardware	3-Feb-05	3-Feb-05	
1.2.1.10.8	50% Calorimeter CCR Detectors tested	14-Feb-05	30 Dec 04	
1.3.5.5.5	Arrival of 70 L3 & 15 DAQ PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.5.6.5	Arrival of 140/20 PCs from the vendor	24-Mar-05	24-Mar-05	
1.3.3.8.3.3	Begin Production of XFT Linker Modules	24-Mar-05	24-Mar-05	
1.3.3.2.6.9	Begin Production Finder SL7 boards	28-Mar-05	28-Mar-05	
1.3.5.8	Finish Purchase of Computers for L3/DAQ	14-Apr-05	14-Apr-05	
1.2.1.10.9	Final Calorimeter CPR Detector Tested	15-Apr-05	15-Apr-05	
1.2.1.10.10	Final Calorimeter CCR Detector Tested	15-Apr-05	15-Apr-05	
1.2.1.10.11	Final set of Calorimeter phototubes tested	6-May-05	6-May-05	
1.2.1.10.12	End of Central Preshower Project	6-May-05	6-May-05	
1.2.3.5	End of Calorimetry Project: Level 2	6-May-05	6-May-05	
1.3.4.8	Finish Event-Builder Upgrade	31-May-05	31-May-05	
1.3.1.14.16	Data Concentrator Production Completed	29-Jul-05	6-Jun-05	
1.3.3.10.4.6	XFT Production Stereo Modules complete	18-Aug-05	18-Aug-05	
1.3.3.23	XFT Ready for Installation at CDF	29-Sep-05	29-Sep-05	
1.3.1.13.10	TDC Production Board testing complete	30-Sep-05	30-Sep-05	
1.3.1.16	Run 2b TDC Ready for Installation	30-Sep-05	30-Sep-05	
1.3.8	Finish Run 2b Trigger DAQ project	30-Sep-05	30-Sep-05	

IV. PROCUREMENT – P. Lukens

No significant procurements were placed during May 2004.

V. PROJECT HIGHLIGHTS

1.2 – Calorimeter

1.2.1 Central Preshower and Crack Detector – Steve Kuhlmann

The Central Preshower/Crack Upgrade started routine full production in May. Fourteen Preshower modules have been assembled and tested at ANL, using fiber pigtails produced at MSU. Spliced fibers are being shipped from FNAL Lab 7 to MSU at about 5 modules/week. Twenty-nine modules of Dubna scintillator have been delivered to FNAL Lab 8 where the groove is cut. All of the mechanical parts have been delivered. Assembly time is about 1 module per assembly area per shift. INFN is providing additional technical manpower for assembly.

The Crack scintillator was delivered to FNAL lab 8, and tile preparation has begun. The first Crack production fiber pigtail was produced by MSU. The High Voltage system, purchased by INFN, was delivered to CDF and is being installed. High voltage cable preparation is underway.

The table below shows the current production status of the CPR and CCR components:

Component	Produced	Total needed	Complete
Preshower tiles	1080	2592	42 %
Preshower spliced fibers	1620	2592	62 %
Preshower fiber pigtails	80	192	42 %
Preshower modules	14	48	29 %
Crack tiles	25	480	5 %
Crack spliced fibers	30	480	6 %
Crack pigtails	3	48	6 %
Crack modules	2	48	4 %

1.2.2 Electromagnetic Timing – Dave Toback

All EM Timing work has been completed. The components installed last year are fully functional and have established an extremely satisfactory operating history.

1.3 – Data Acquisition and Trigger

1.3.1 TDC (Time to Digital Converter) – Henry Frisch, Ting Miao

We held a TDC Design Review during May and received positive comments from the committee about the design and prototype tests. We are carrying out extra tests on the ASDQ input to the TDC from the panel and XFT Trigger flag capture test to address the questions and the concerns from the review committee. Meanwhile, we are preparing for the Preproduction Board assembly and testing.

1.3.2 Level 2 – Ted Liu, Peter Wittich

The CDF Level 2 Trigger system continues to make progress on the following fronts:

- Pulsar hardware, firmware and VME software,
- PCI and CPU performance studies, and
- S-LINK data format definition for all data paths.

The table below shows the current production status of the Level 2 components:

Component	Produced	Total needed	Complete
Pulsar boards	15	30	50 %
S-Link LSC/LDC cards	20	20	100 %
S-Link PCI cards	6	12	50 %
S-Link fibers	30	30	100 %
AUX cards	20	20	100 %
Hotlink mezzanine cards	20	20	100 %
Taxi mezzanine cards	30	30	100 %
Hotlink/Taxi fibers	120	120	100 %
Fiber splitters	40	60	67 %
L2 decision CPUs	2	6	33 %

All pulsar motherboards have arrived and testing continues. Half of them have been fully tested in May and all have been found satisfactory. All 19 pairs of the S-Link LDC/LSC cards have arrived at Fermilab and have been tested satisfactorily. The firmware implementation and testing for various data paths is in progress and some of them have already been tested with beam successfully. The fiber splitting is complete and all test passes have been tested with the split system. The LVDS signal splitting for the system has also been completed.

1.3.3 XFT (eXtremely Fast Tracker) II – Richard Hughes, Brian Winer

Work continues on the simulation of the upgraded XFT. Recent developments with respect to the degraded performance of the COT have focused the simulation work on understanding how an upgraded device will perform with both an increase in instantaneous luminosity and a reduction of single hit efficiency due to an aged COT. The Linker upgrade work at Ohio State University has been focused on implementing the improved tracking linking algorithm in the latest Altera Stratix devices. Purdue has been provided all the mechanical and layout drawings for the former Linker board and will be working on pulling together a Linker board. The main focus now is on the development of the Finder board.

1.3.4 Event Builder – Bruce Knuteson

The final production order of single board computers for reading out VME event fragments has been placed. This is a major milestone, representing the last of the large hardware orders needed for the Event Builder upgrade.

A careful software design has been completed. Code is now being written to implement the two main packages that control traffic flow across the switch: the Event Builder Proxy,

which talks to CDF Run Control and serves as the “brain” of the system; and the Scanner CPU, which reads VME-based event information and sends this to the Level 3 farm.

1.3.6 SVT (Silicon Vertex Tracker) – Luciano Ristori

We are not planning to begin work on the Silicon Vertex Tracker trackfitter and merger boards until later in calendar year 2004.

1.3.7 Silicon Detector DAQ Upgrades – Nicola Bacchetta

We are not planning to perform any additional work on the Silicon Detector DAQ upgrades until later in calendar year 2004.

VI. FINANCIAL STATUS (as of 31 May 2004)

The baseline cost of the Project is \$10,375K, and consists of the costs for the scope of the Run IIb Project (\$8,702K) plus the closeout costs of the silicon detector upgrade (\$1,673K), which will no longer be constructed.

The following financial table is attached:

CDF RunIIb Obligations Report - This report provides a summary, at Level 2, of the outstanding requisitions and purchase orders where money has been committed but for which the Project has not been invoiced. This does not include requisitions in the system that have not had a Fermilab Purchase Order number assigned as of the date of the report.

CDF Project Obligations Report Through 31 May 2004

CDF RIib EQU - May FYO4 IN \$K							
Task Number	Expenditure Category	Current Mth Total Cost	Current Mth Obligation	YTD Total Cost	YTD Obligations w/Indirect	Current PO Open Comm	Prior Yr Total Cost
	M&S	33.3	621.7	293.1	349.6	101.7	221.0
	SWF	0.3	0.3	222.1	222.1	0.0	346.1
	OH	0.7	0.0	87.8	87.8	0.0	140.2
	Total 1.1	34.3	621.4	603.0	39.7	101.7	707.2
	M&S	37.9	2.8	75.8	231.7	155.9	0.0
	SWF	20.9	20.9	68.0	68.0	0.0	20.6
	OH	7.5	0.0	27.8	27.8	0.0	6.3
	Total 1.2	66.3	23.7	171.6	327.4	155.9	26.9
	M&S	21.5	0.2	224.4	281.3	191.3	2.9
	SWF	14.4	14.4	68.0	68.0	0.0	0.0
	OH	6.8	0.0	34.3	34.3	0.0	0.5
	Total 1.3	42.8	14.6	326.7	383.6	191.3	3.4
	M&S	3.3	3.3	12.4	12.4	0.0	13.3
	SWF	9.8	9.8	96.1	96.1	0.0	126.7
	OH	3.5	0.0	30.7	30.7	0.0	40.1
	Total 1.4	16.6	13.1	139.2	139.2	0.0	180.1
Total Project	M&S	96.1	615.4	605.7	175.8	448.8	237.2
	SWF	45.4	45.4	454.1	454.1	0.0	493.5
	OH	18.6	18.6	180.6	180.6	0.0	187.0
Grand Total		160.0	551.4	1240.4	810.5	448.8	917.6

Total Project Cost (Inception to Date): 2158.1

VII. VARIANCE ANALYSIS – P. Lukens

The most significant variance the Project has from the baseline schedule is in the TDC and XFT development. This will be best remedied by additional manpower from the collaboration, and we are currently trying to secure this effort. We anticipate formalizing new schedules for these projects prior to the July Director's Review.

VIII. BASELINE CHANGES

No Change Control action documents were approved during May 2004.

IX. FUNDING PROFILES

The funding profile is shown below:

	Funding Plan in Current Year \$K				
	FY02	FY03	FY04	FY05	Total
DOE MIE	\$ 3,460	\$ 3,509	\$ 1,673	\$ 1,732	\$ 10,375
DOE R&D	\$ 1,670	\$ 480			\$ 2,150
Foreign Contributions	\$ 39	\$ 342	\$ 252	\$ 10	\$ 643
U.S. Universities	\$ 24	\$ 225	\$ 103	\$ 26	\$ 378
Total	\$ 5,193	\$ 4,556	\$ 2,028	\$ 1,768	\$ 13,545